
**Information technology — Open Systems
Interconnection — Systems Management:
Summarization Function**

iTeh STANDARD PREVIEW

*Technologies de l'information — Interconnexion de systèmes ouverts
(OSI) — Gestion-systèmes: Fonction de résumé*

ISO/IEC 10164-13:1995

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Contents

	<i>Page</i>
1 Scope	1
2 Normative references	1
2.1 Identical Recommendations International Standards	2
2.2 Paired Recommendations International Standards equivalent in technical content	2
2.3 Additional references	3
3 Definitions	3
3.1 Basic reference model definitions	3
3.2 Management framework definitions	3
3.3 Systems management overview definitions	3
3.4 CMIS definitions	3
3.5 Metric objects and attributes definitions	4
3.6 Standard definitions of statistics	4
3.7 Alarm reporting function definitions	4
3.8 OSI conformance testing definitions	4
3.9 Additional definitions	4
4 Abbreviations	5
5 Conventions	5
6 Requirements	5
7 Model	6
7.1 Summarization model	6
7.2 Summarization scheduling	8
8 Generic definitions	10
8.1 Managed objects	10
8.2 Generic notifications	24
8.3 Generic actions	26
8.4 Parameter definitions	27
8.5 Compliance	28
8.6 Generic definitions from the object management function	28
8.7 Generic definitions from the state management function	28
8.8 Generic definitions from the event report management function	28
8.9 Generic definitions from the generic network information model	28
8.10 Generic definitions from metric objects and attributes	28
8.11 Generic definitions from the alarm reporting function	28
9 Service definition	29
9.1 Introduction	29
9.2 Initiation, termination, modification and retrieval services	29
9.3 Notification services	29
9.4 Action services	29
10 Systems management functional units	37

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11	Protocol and abstract syntax.....	37
11.1	Scan report service elements of procedure.....	37
11.2	Statistical report service elements of procedure.....	38
11.3	Buffered scan report service elements of procedure	38
11.4	Activate scan report elements of procedure	39
11.5	Report buffer elements of procedure	39
11.6	Activate dynamic simple scan elements of procedure	40
11.7	Activate statistical report elements of procedure	40
11.8	Abstract syntax.....	41
11.9	Negotiation of functional units	44
12	Relationships with other functions.....	45
13	Conformance.....	45
13.1	General conformance class requirements.....	45
13.2	Dependent conformance class requirements.....	46
13.3	Conformance to support managed object definitions.....	46
Annex A	– Summarization management support objects.....	47
A.1	Managed object class definitions	47
A.2	Calculation package definition.....	50
A.3	Package definitions	50
A.4	Attribute definitions	51
A.5	Notification definitions.....	54
A.6	Action definitions.....	55
A.7	Name binding definitions.....	56
A.8	Parameter Templates.....	56
A.9	ASN.1 definitions	56

[ISO/IEC 10164-13:1995](https://standards.iteh.ai/catalog/standards/sist/64286e03-8851-4518-8f6b-4a0d17be9ec2/iso-iec-10164-13-1995)

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

International Standard ISO/IEC 10164-13 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 21, *Open Systems Interconnection, data management and open distributed processing*, in collaboration with ITU-T. The identical text is published as ITU-T Recommendation X.738.

ISO/IEC 10164 consists of the following parts, under the general title *Information technology — Open Systems Interconnection — Systems Management*:

- *Part 1: Object management function*
- *Part 2: State management function*
- *Part 3: Attributes for representing relationships*
- *Part 4: Alarm reporting function*
- *Part 5: Event report management function*
- *Part 6: Log control function*
- *Part 7: Security alarm reporting function*
- *Part 8: Security audit trail function*
- *Part 9: Objects and attributes for access control*
- *Part 10: Accounting metering function*
- *Part 11: Metric objects and attributes*
- *Part 12: Test management function*
- *Part 13: Summarization function*
- *Part 14: Confidence and diagnostic test categories*
- *Part 15: Scheduling function*
- *Part 16: Management knowledge management function*

Annex A forms an integral part of this part of ISO/IEC 10164.

Introduction

ISO/IEC 10164 is a multipart standard developed according to ISO 7498 and ISO/IEC 7498-4. ISO/IEC 10164 is related to the following International Standards:

- ISO/IEC 9595:1991, *Information technology — Open Systems Interconnection — Common management information service definition*;
- ISO/IEC 9596-1:1991, *Information technology — Open Systems Interconnection — Common management information protocol — Part 1: Specification*;
- ISO/IEC 10040:1992, *Information technology — Open Systems Interconnection — Systems management overview*;
- ISO/IEC 10165, *Information technology — Open Systems Interconnection — Structure of management information*.

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INTERNATIONAL STANDARD

ITU-T RECOMMENDATION

INFORMATION TECHNOLOGY – OPEN SYSTEMS INTERCONNECTION – SYSTEMS MANAGEMENT: SUMMARIZATION FUNCTION

1 Scope

This Recommendation | International Standard defines the Summarization Function. The Summarization Function is a Systems Management function which may be used by an application process in a centralised or decentralised management environment to interact for the purpose of systems management, as defined by the OSI Management Framework, CCITT Rec. X.700 | ISO/IEC 7498-4. This Recommendation | International Standard defines a function which consists of generic definitions and services. This function is positioned in the application layer of the OSI reference model (CCITT Rec. X.200 | ISO 7498) and is defined according to the model provided by ISO 9545. The role of systems management functions is described by CCITT Rec. X.701 | ISO/IEC 10040. The Summarization Function specifies methods to observe and report attribute values. It also specifies methods for reporting statistics based on attribute values, all observed at the same time. These attribute values and statistics provide summary information concerning a set of managed objects and their attributes at one or more distinct points in time. The statistics are calculated across managed objects, not over time.

This Recommendation | International Standard

- identifies the set of requirements satisfied by the function;
- provides a model for the behaviour of the summarization objects;
- specifies the management requirements of the function and how these are realised by specification of managed objects and their behaviour;
- specifies the mapping of these services onto the CMIS services; and
- specifies the abstract syntax of the parameters of the MAPDUs that will be used to refer to managed objects and their characteristics.

This Recommendation | International Standard

- does not define the nature of any implementation intended to provide the Summarization function;
- does not specify the manner in which management is to be accomplished by the user of the Summarization function;
- does not define the nature of any interactions which result in the use of the Summarization function;
- does not specify the services necessary for the establishment, normal and abnormal release of a management association;
- does not define the interactions which result by the simultaneous use of several management functions;
- does not define connection establishment or authorisation requirements for the use of these functions or for any associated activity; and
- does not preclude the definition of further metric object classes to provide measurements for inclusion in the function.

2 Normative references

The following Recommendations | International Standards contain provisions which, through reference in this text, constitute provisions of this Recommendation | International Standard. At the time of publication, the editions indicated were valid. All Recommendations | Standards are subject to revision, and parties to agreements based on this Recommendation | International Standard are encouraged to investigate the possibility of applying the most recent editions of the Recommendation/Standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards. The Telecommunication Standardization Bureau of the ITU maintains a list of currently valid ITU-T Recommendations.

2.1 Identical Recommendations | International Standards

- CCITT Recommendation X.701 (1992) | ISO/IEC 10040:1992, *Information technology – Open Systems Interconnection – Systems management overview.*
- CCITT Recommendation X.720 (1992) | ISO/IEC 10165-1:1993, *Information technology – Open Systems Interconnection – Structure of management information: Management information model.*
- CCITT Recommendation X.721 (1992) | ISO/IEC 10165-2:1992, *Information technology – Open Systems Interconnection – Structure of management information: Definition of management information.*
- CCITT Recommendation X.722 (1992) | ISO/IEC 10165-4:1992, *Information technology – Open Systems Interconnection – Structure of management information: Guidelines for the definition of managed objects.*
- CCITT Recommendation X.730 (1992) | ISO/IEC 10164-1:1993, *Information technology – Open Systems Interconnection – Systems Management: Object management function.*
- CCITT Recommendation X.731 (1992) | ISO/IEC 10164-2:1993, *Information technology – Open Systems Interconnection – Systems Management: State management function.*
- CCITT Recommendation X.733 (1992) | ISO/IEC 10164-4:1992, *Information technology – Open Systems Interconnection – Systems Management: Alarm reporting function.*
- CCITT Recommendation X.734 (1992) | ISO/IEC 10164-5:1993, *Information technology – Open Systems Interconnection – Systems Management: Event report management function.*
- CCITT Recommendation X.735 (1992) | ISO/IEC 10164-6:1993, *Information technology – Open Systems Interconnection – Systems Management: Log control function.*
- ITU-T Recommendation X.739 (1993) | ISO/IEC 10164-11:1994, *Information technology – Open Systems Interconnection – Systems Management: Metric objects and attributes.*

2.2 Paired Recommendations | International Standards equivalent in technical content

- CCITT Recommendation X.200 (1989), *Reference model of Open Systems Interconnection for CCITT Applications.*
ISO 7498:1984, *Information processing systems – Open Systems Interconnection – Basic Reference Model.*
<https://standards.iteh.ai/catalog/standards/sist/64286e03-8851-4518-8f6b-4a3d76c2250c/iso-7498-1984>
- CCITT Recommendation X.209 (1988), *Specification of Basic Encoding Rules for abstract syntax notation.*
ISO 8825:1990, *Information technology – Open Systems Interconnection – Specification of Basic Encoding Rules for Abstract Syntax Notation One (ASN.1).*
- CCITT Recommendation X.210 (1988), *Open Systems Interconnection layer service definition conventions.*
ISO/TR 8509:1987, *Information processing systems – Open Systems Interconnection – Service conventions.*
- CCITT Recommendation X.700 (1989), *Management framework definition for Open Systems Interconnection (OSI) for CCITT applications.*
ISO 7498-4:1989, *Information processing systems – Open Systems Interconnection – Basic Reference Model – Part 4: Management framework.*
- CCITT Recommendation X.710 (1991), *Common management information service definition for CCITT applications.*
ISO/IEC 9595:1991, *Information technology – Open Systems Interconnection – Common management information service definition.*
- CCITT Recommendation X.711 (1991), *Common management information protocol specification for CCITT applications.*
ISO/IEC 9596-1:1991, *Information technology – Open Systems Interconnection – Common management information protocol – Part 1: Specification.*
- CCITT Recommendation X.290 (1991), *OSI conformance testing methodology and framework for protocol recommendations for CCITT applications.*
ISO/IEC 9646-1:1991, *Information technology – OSI conformance testing methodology and framework – Part 1: General concepts.*

2.3 Additional references

- ISO/IEC 3534-1:1993, *Statistics – Vocabulary and symbols – Part 1: Probability and general statistical terms*.
- ISO/IEC 9545:1989, *Information processing systems – Open Systems Interconnection – Application Layer structure*.
- CCITT Recommendation M.3100 (1992), *Generic Network Information Model*.

3 Definitions

For the purposes of this Recommendation | International Standard the following definitions apply.

3.1 Basic reference model definitions

This Recommendation | International Standard makes use of the following terms defined in CCITT Rec. X.200 | ISO 7498:

- a) open system;
- b) systems management.

3.2 Management framework definitions

This Recommendation | International Standard makes use of the following terms defined in CCITT Rec. X.700 | ISO/IEC 7498-4:

- a) managed object;
- b) management information.

3.3 Systems management overview definitions

This Recommendation | International Standard makes use of the following terms defined in CCITT Rec. X.701 | ISO/IEC 10040:

- a) agent;
- b) agent role;
- c) dependent conformance;
- d) general conformance;
- e) generic definitions;
- f) managed system;
- g) management operation;
- h) manager;
- i) manager role;
- j) managing system;
- k) notification;
- l) systems management functional unit.

3.4 CMIS definitions

This Recommendation | International Standard makes use of the following terms defined in CCITT Rec. X.710 | ISO/IEC 9595:

- a) attribute;
- b) common management information service.

3.5 Metric objects and attributes definitions

This Recommendation | International Standard makes use of the following terms defined in ITU-T Rec. X.739 | ISO/IEC 10164-11:

- a) capacity;
- b) granularity period;
- c) metric algorithm;
- d) metric attribute;
- e) metric object;
- f) observed attribute;
- g) observed object;
- h) percentile;
- i) scan.

3.6 Standard definitions of statistics

This Recommendation | International Standard makes use of the following terms defined in ISO 3534-1:1993.

- a) fractile of a probability distribution;
- b) frequency distribution;
- c) mean of a random variable;
- d) range;
- e) relative frequency;
- f) variance.

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3.7 Alarm reporting function definitions

This Recommendation | International Standard makes use of the following terms defined in CCITT Rec. X.733 | ISO/IEC 10164-4:

- alarm.

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3.8 OSI conformance testing definitions

This Recommendation | International Standard makes use of the following terms defined in CCITT Rec. X.290 | ISO/IEC 9646-1.

- system conformance statement.

3.9 Additional definitions

For the purposes of this Recommendation | International Standard, the following definitions apply.

- 3.9.1 aggregation:** The process of combining observed attribute values.
- 3.9.2 ensemble statistic:** A statistic derived from observed attributes across managed objects at a specified point in time.
- 3.9.3 numeric attribute:** An attribute whose value may be either integer or real.
- 3.9.4 report period:** The time between emitting notifications containing the reports of the collected aggregate values or statistical information. The report period begins and ends on granularity period boundaries, and therefore consists of one or more granularity periods.
- 3.9.5 summarization:** The process of aggregating and optionally applying algorithms to obtained observed attribute values to produce summary information.
- 3.9.6 summarization object:** A managed object which provides summary reports of multiple observations of the attribute values of many managed objects.
- 3.9.7 summary report:** A notification or action reply that contains the results of aggregations of values of observed attributes.

4 Abbreviations

ASN.1	Abstract Syntax Notation One
CMIP	Common management information protocol
CMIS	Common management information service
Conf	Confirmation
GP	Granularity period
Ind	Indication
Id	Identifier
MAPDU	Management application protocol data unit
max	Maximum
min	Minimum
MOCS	Managed object conformance statement
PICS	Protocol implementation conformance statement
Req	Request
Rsp	Response
RP	Report period
SMAPM	System management application protocol machine

5 Conventions

This Specification defines services for the Summarization function following the descriptive conventions defined in CCITT Rec. X.210 | ISO/TR 8509.

The following notation is used in the service parameter tables:

- M The parameter is mandatory.
- C The parameter is conditional. The condition(s) are defined by the text which describes the parameter.
- (=) The value of the parameter is identical to the corresponding parameter in the interaction described by the preceding related service primitive.
- U The use of the parameter is a service-user option.
- The parameter is not present in the interaction described by the primitive concerned.
- P The parameter is subject to the constraints imposed by CCITT Rec. X.710 | ISO/IEC 9595.

NOTE – The parameters which are marked “P” in service tables of this Specification are mapped directly onto the corresponding parameters of the CMIS service primitive, without changing the semantics or syntax of the parameters. The remaining parameters are used to construct an MAPDU.

6 Requirements

Summarization provides the ability to aggregate observed attribute values and/or provide ensemble statistical information about observed attribute values.

The Summarization Function shall provide for:

- The ability for a managing system to request summarization of attribute values.
- The ability to summarize values on:
 - a) a single attribute type of a single managed object;
 - b) multiple attribute types of a single managed object;
 - c) a single attribute type of multiple managed objects;
 - d) multiple attribute types of multiple managed objects.
- The ability to provide summarized information gathered:
 - a) at a single point in time, prescheduled or on-demand;
 - b) over a specified interval of time;

- c) periodically over specific intervals of time.
- The scheduling of summarization activity over a specified period of time.
- The aggregation of observed attribute values on a single managed system.
- The identification of the managed objects and their attributes to be summarized.
- A mechanism for the selection of managed objects which have the same set of attributes to be summarized.
- The ability to specify the selection criteria for managed objects to be observed and their attributes to be summarized, at any point in time.
- The ability to provide ensemble statistics of the information gathered.
- The ability for a managed system to send event reports to a managing system to notify:
 - a) the results of the summarization;
 - b) the identification of the units of measure of the results;
 - c) the identification of the sources of the attribute samples used in the summary;
 - d) the identification of the start time of the summary period;
 - e) the parameters of the algorithm used for calculating statistical measures;
 - f) the identification of any missing samples in the summary;
 - g) the identification of any samples in the summary whose values are suspected of being incomplete or incorrect;
 - h) optionally, the timestamping of the observed values;
 - i) the ability to report an incomplete scan.
- The concise reporting of large quantities of summarized information.

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7 Model

7.1 Summarization model

7.1.1 Introduction to the model

Summarization is the process of aggregating and optionally applying algorithms to observed attribute values to produce summary information.

Information is obtained by observing the attributes of a managed object. The managed objects from which information may be obtained include, for example:

- a) managed objects representing a management view of an underlying resource;
- b) management support objects (e.g. metric objects, log record objects).

These managed objects may be described generically as observed objects. That is, they have attributes, some of whose values are obtained by management operations and notifications.

Summarization objects obtain information, process such information to produce summary information, and issue summary report notifications.

A summarization object may have attributes to determine:

- a) the identities of the managed objects which it is observing;
- b) the identities of the attributes which it is observing;
- c) the contents of the summary reports; and
- d) the timing and frequency of observations.

Information obtained from observed objects is processed according to the behaviour of the summarization object class. Such behaviour may include:

- a) algorithms for calculating summary information; and
- b) methods for identifying missing values.

Summary information is issued in the form of notifications or as replies to requests which are specified in the summarization object class definition. Such specifications may include:

- a) the structure of information to be reported;
- b) the circumstances which trigger the issuing of a notification; and
- c) the state information related to the summarization object (e.g. operational state, administrative state, availability status).

7.1.2 Properties of summarization object classes

Figure 1 illustrates a summarization object observing attributes of observed managed objects. The summarization object generates summaries in the form of notifications, or as a result of a request. The notifications may be forwarded as event reports by event forwarding discriminators (as discussed in CCITT Rec. X.734 | ISO/IEC 10164-5). The notifications may also be logged (as discussed in CCITT Rec. X.735 | ISO/IEC 10164-6).

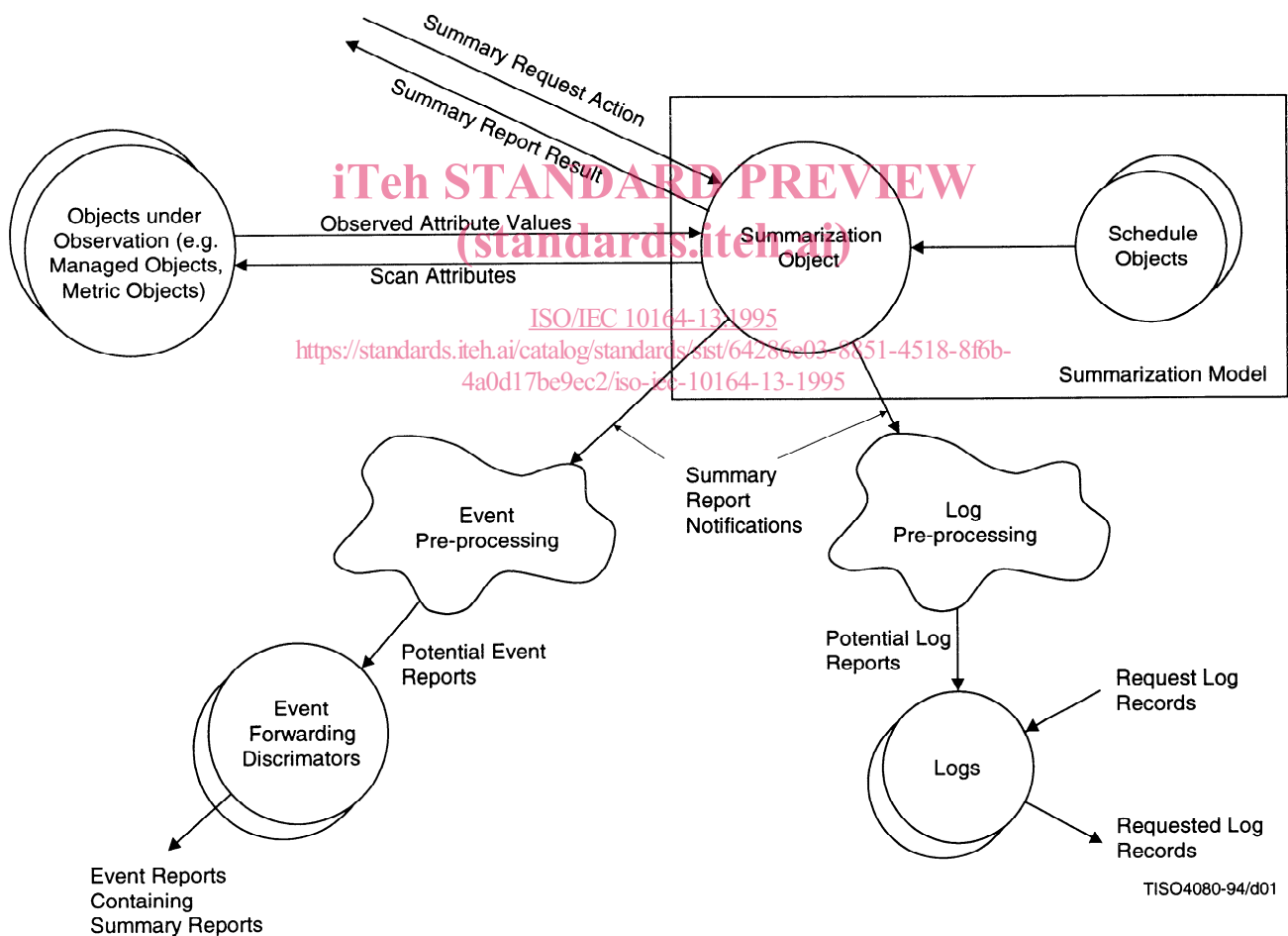


Figure 1 – Summarization model

A summarization object includes attributes for scheduling the underlying scanning and summary reporting processes, and various mechanisms to select observed objects and their attributes to be observed.

The following instantiable summarization managed object classes are defined for the Summarization Function. The instantiable classes are:

- *Simple scanner* – Scans the same set of attributes across a set of managed objects and generates reports of the observed attribute values at the end of each granularity period. The managed objects are selected using either a set of explicit names or using a scoping and filtering mechanism. The simple scanner may also return summary reports in an action reply when stimulated by an action.
- *Dynamic simple scanner* – Scans the same set of attributes across managed objects selected using the parameters specified in the information in the action request. It returns summary reports in an action reply. The term “dynamic” is used to indicate that the selection criteria are specified dynamically within each action.
- *Mean scanner* – Scans the same set of attributes across a set of managed objects and generates reports of the mean of the observed attribute values at the end of each granularity period. The managed objects are selected using either a set of explicit names or using a scoping and filtering mechanism. The mean scanner may also return summary reports in an action reply when stimulated by an action.
- *Mean variance scanner* – Scans the same set of attributes across a set of managed objects and generates reports of the mean and variance of the observed attribute values at the end of each granularity period. The managed objects are selected using either a set of explicit names or using a scoping and filtering mechanism. The mean variance scanner may also return summary reports in an action reply when stimulated by an action.
- *Min max scanner* – Scans the same set of attributes across a set of managed objects and generates reports of the minimum, maximum, and optionally the mean of the observed attribute values at the end of each granularity period. The managed objects are selected using either a set of explicit names or using a scoping and filtering mechanism. The min max scanner may also return summary reports in an action reply when stimulated by an action.
- *Percentile scanner* – Scans the same set of attributes across a set of managed objects and generates reports of the minimum, j^{th} percentile, median, $(100-j)^{\text{th}}$ percentile, maximum, and optionally the mean of the observed attribute values at the end of each granularity period. The managed objects are selected using either a set of explicit names or using a scoping and filtering mechanism. The percentile scanner may also return summary reports in an action reply when stimulated by an action.
- *Heterogeneous scanner* – Scans potentially different sets of attributes for a set of explicitly named observed objects and reports the results at the end of each granularity period. The heterogeneous scanner may also return summary reports in an action reply when stimulated by an action. The term “heterogeneous” is used to indicate that values of different attribute types for different managed objects can be included in the report.
- *Buffered scanner* – Similar to the heterogeneous scanner, but retains scanned values so that the results of multiple granularity periods can be reported together. In addition, at the time of reporting, it will scan a list of attributes of arbitrary type whose attribute values can be included in the report.

Diagram a) of Figure 2 illustrates the timing of the scanning process for non-buffered scanners. At the end of each granularity period, a scan is initiated, observed attribute values are collected, optionally statistics are calculated (in the case of statistical scanners only), and notifications are emitted. Diagram b) of Figure 2 illustrates the timing of the scanning process for buffered scanners. This process is similar to that used by the non-buffered scanners, except that buffered scanners retain collected data for one or more granularity periods before emitting notifications containing the collected data. All scanners also can produce summary information in action replies after being stimulated by action requests. Figures 2a and 2b do not apply to dynamic simple scanners where the summary reports are only produced as a result of actions. Scanner behaviour is discussed in further detail in 8.1.

7.2 Summarization scheduling

7.2.1 Scheduling of the scanner

To schedule scanning the summarization objects use the optional scheduling mechanisms defined in CCITT Rec. X.721 | ISO/IEC 10165-2 and in CCITT Rec. X.734 | ISO/IEC 10164-5. These mechanisms provide for daily scheduling, weekly scheduling, duration scheduling, and scheduling by an external scheduler.

Since scanning may be controlled by the scheduling of the scanner, the mechanisms that determine the scheduling of the scanner indirectly determine the scheduling of summary reports as well.

Since summarization objects and metric objects are both scheduled to observe attribute values, when summarization objects are observing metric objects the schedule of the objects should be coordinated to ensure reliable results.

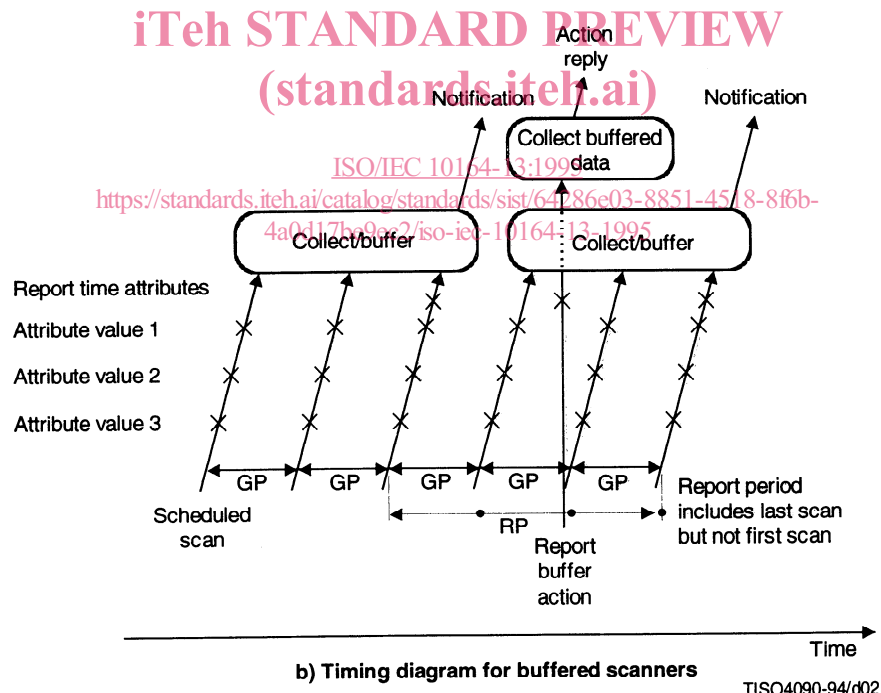
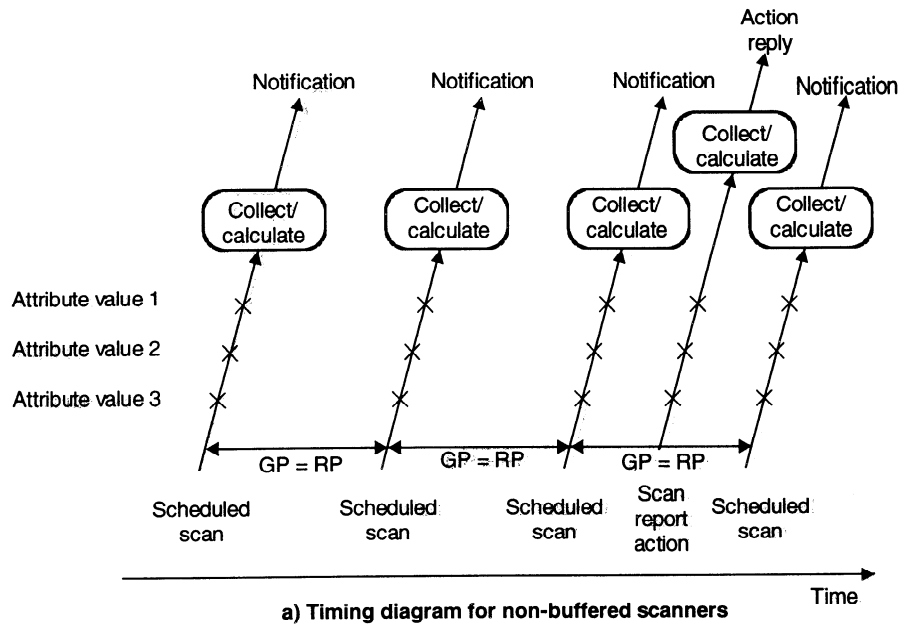


Figure 2